phenomenon is cased as Tonks-Dattner resonance from the name of the detector. According to subsequent research, it is explained that the mechanism causing this resonance is that electron plasma wave transmitted in radial direction is excited by electromagnetic wave, and resonant absorption is caused when the excited electron plasma wave is reflected at the plasma end and standing wave is generated. Further, since there is relationship between the resonance frequency and the electron plasma angle frequency ω_p, if the plasma density is varied, the Tonks-Dattner resonance frequency is also varied. That is, the Tonks-Dattner resonance frequency provides plasma density information.

The present invention provides a probe used for measuring plasma density information, comprising:

a dielectric tube whose tip end is closed;

an antenna accommodated in the tube at its tip end side for radiating high-frequency power; and

a cable accommodated in the tube at its rear side and connected to the antenna for transmitting the high-frequency power.

When the plasma density information is measured using the probe used for measuring plasma density information of the invention, the probe is set such that the tip end of the tube is brought into contact with the plasma to be measured, the high-frequency power sent through the cable is supplied to the plasma from the antenna through the dielectric tube wall, and the reflection power of the high-frequency power required for measuring the plasma absorption frequency is received by the antenna, and taken out through the cable. Since the range where the high-frequency power from the antenna influences the plasma is not so wide, it is also possible to obtain a local plasma density information if the amount of the high-frequency power is adjusted. That is, if

the plasma density information measuring probe of the invention is used, it is possible to easily prepare necessary state for measuring the plasma density information, and to obtain spatial resolution. Further, since the antenna is covered with the dielectric tube, plasma is not contaminated, and the antenna is not damaged by the plasma and thus, the lifetime is long.

In the probe used for measuring plasma density information of the invention, it is preferable that the antenna and the cable accommodated in the dielectric tube are capable of moving along a longitudinal direction of the tube such that a position of the antenna in the tube can be varied. In this example, the position of the antenna in the dielectric tube is changed along the longitudinal direction of the tube several times. And plasma absorption frequencies at the antenna positions are measured. Among the several absorption frequencies obtained by this measurement, the lowest frequency that is not varied even if the position of the antenna is changed is obtained as a surface wave resonance frequency.

In the probe used for measuring plasma density information of the invention, it is preferable that a conductor for preventing a leakage of ejected electromagnetic wave from the antenna is disposed at a position slightly back from the antenna such as to occlude a gap between the cable and an inner surface of the tube. With this structure, since the conductor disposed slightly back from the antenna prevents the electromagnetic wave power discharged from the antenna from leaking outside except plasma, measuring error due to the leakage of the high-frequency power is avoided.

In the probe used for measuring plasma density information of the invention, it is preferable that probe cooling means for forcibly cooling the probe is disposed. According to this example, since the probe is forcibly cooled by the probe cooling means, the measuring error by temperature rise of the tube or cable is avoided.

In the probe used for measuring plasma density information of the invention, it is preferable that the cable for transmitting high-frequency power comprises a conductor tube for a core wire and a shield, and an insulative ceramics material for filling a gap between the core wire and the conductor tube. According to this example, since the gap between the core wire and the conductor tube. According to this example is filled with the heat-resistant insulative ceramics material, the heat-resistance of the cable is enhanced.

In the probe used for measuring plasma density information of the invention, it is preferable that a surface of the dielectric tube is coated with metal such that a measuring area of the dielectric tube is not coated. According to this example, since the surface of the dielectric tube is coated with metal such that the measuring area of the dielectric tube is not coated, the local state of the measuring area that is not coated with metal is strongly reflected to the measured result, and the spatial resolution is enhanced.

In the probe used for measuring plasma density information of the invention, it is preferable that the antenna is extended closely along an inner surface of the dielectric tube. With this structure, since the high-frequency power irradiated from the antenna is effectively supplied to the plasma, the supply amount of the high-frequency power may be small, and the measuring precision is enhanced.

A plasma density information measuring apparatus of the present invention comprises:

sweep-frequency type high-frequency power supplying means for supplying high-frequency power to plasma while sweeping frequency;

reflection power amount detecting means for detecting a reflection amount of the high-frequency power; and

power reflection coefficient frequency characteristics obtaining means for